

CLAIMS

1. An image retrieving device comprising:
- an image reading unit which reads a sequence of image data recorded with image pickup times;
 - 5 an image data holding unit which holds the sequence of image data that has been read by the image reading unit;
 - an attribute information reading unit which reads attribute information containing at least image pickup positions where the sequence of image pickup data has been
 - 10 obtained and the image pickup times thereof;
 - a matching unit which matches the sequence of image data held in the image data holding unit with the attribute information read by the attribute information reading unit based upon the image pickup times;
 - 15 an image database which holds the matching relationship that has been determined by the matching unit;
 - a map data holding unit which holds map data;
 - a map display processing unit which displays the map data on a map display unit based upon the map data;
 - 20 an image retrieving unit which retrieves the image database;
 - a locus display processing unit which allows the image retrieving unit to retrieve for image data having image pickup positions within a map displayed by the map display
 - 25 unit, and displays the retrieved pickup positions on the

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map as a locus;

an image display unit which displays the sequence of image data;

a position specifying unit which specifies a position
5 of the map displayed on the map display unit; and

an image processing unit which acquires image data corresponding to the image pickup position in the vicinity of the position specified by the position specifying unit from the image data holding unit, and reproduces and displays
10 the resulting image data on the image display unit.

2. The image retrieving device according to claim 1, wherein the attribute information further includes information related to the image pickup orientation, image
15 pickup direction, image pickup angle or combinations of these.

3. The image retrieving device according to claim 1, wherein the locus display processing unit further comprises
20 a locus-type button display processing unit which allows the image retrieving unit to retrieve for a sequence of image data having image pickup positions within the map displayed by the map display unit, and displays a route formed by connecting the image pickup positions of the sequence of
25 image data thus retrieved and a slide bar that slides on

the route, and is constituted by an inputting button for indicating a reproduction start point of the image data on the map.

- 5 4. The image retrieving device according to claim 1, further comprising a route searching unit which allows the image retrieving unit to retrieve for a sequence of image data located between two positions indicating the image pickup start and the image pickup end specified by the position specifying unit, generates a route between the two
10 positions that passes through the image pickup positions indicated by the sequence of image data, displays the locus of the image pickup positions along the route on the map display unit, and, when an image pickup position is specified
15 by the position specifying unit, displays image data on the route succeeding to the image pickup position.

5. The image retrieving device according to claim 1, further comprising:
20 a junction image holding unit which holds a crossing point image picked up on the periphery of a crossing point at which sequences of image data intersect each other;
a crossing-point database which holds the matching relationship in which the crossing-point image and the
25 attribute information of the crossing-point image are

matched with each other; and

a connection interpolating unit which, when image data passing through the crossing point exists, retrieves the crossing-point database, and interpolates images on the periphery of the crossing point by using the crossing-point image held in the junction image holding unit.

6. The image retrieving device according to claim 1, further comprising an image editing unit which carries out an editing process including cutting and composing processes of the sequence of image data.

7. The image retrieving device according to claim 1, further comprising an image adjusting unit which carries out a thinning process or an interpolating process on the image data so that the image pickup position gaps between the respective pieces of image data constituting the sequence of image data are made virtually the same.

8. The image retrieving device according to claim 1, wherein the map data holding unit holds three-dimensional map data, and the map display processing unit displays the three-dimensional map on the map display unit stereoscopically based upon the three-dimensional map data.

5 display unit on the map display unit.

10 three-dimensional display position, direction and angle as
the image pickup position, image pickup direction and image
pickup angle of the image displayed on the image display
unit, on the map display unit in synchronism with the image.

15 11. The image retrieving device according to claim 8,
further comprising:

an image position specifying unit which specifies a position on the display screen of the image display unit; and

20 a three-dimensional position display processing unit
which calculates the three-dimensional position
corresponding to the position specified by the image position
specifying unit based upon the image-pickup position, the
image-pickup direction and the image-pickup angle of the
25 image data displayed on the image display unit, and displays

the resulting three-dimensional position on the map display unit.

12. The image retrieving device according to claim 8,
5 further comprising:

an image position specifying unit which specifies a position on the display screen of the image display unit;

a three-dimensional model holding unit which holds a three-dimensional model; and

10 a three-dimensional model image composing unit which composes the three-dimensional model into the image and for displaying the resulting image at the position specified by the image position specifying unit in a manner so as to match the image displayed on the image display unit.

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13. The image retrieving device according to claim 12, further comprising a three-dimensional model and map composing unit which calculates a three-dimensional position corresponding to the position specified by the image
20 position specifying unit based upon the image-pickup position, image-pickup direction and image-pickup angle of the image data displayed on the image display unit, and composes the three-dimensional model and the map and displays the resulting map at the three-dimensional position on the
25 map displayed by the map display unit.

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14. The image retrieving device according to claim 1, further comprising:

a map attribute retrieving unit which retrieves the map data holding unit for map attribute information
5 corresponding to the image pickup position at which the image data is obtained; and

a map attribute information display unit which displays the map attribute information.

10 15. The image retrieving device according to claim 14, further comprising a map retrieving unit which retrieves a position on the two-dimensional map based upon the specified map attribute.

15 16. The image retrieving device according to claim 1, further comprising a subject-position matching unit which matches the subject position of an image and the pickup position thereof with each other.

20 17. The image retrieving device according to claim 16, further comprising:

a subject angle detection unit which detects an angle between the subject face of an image and the lens face of the image collecting device for collecting the sequence of
25 image data; and

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an image angle correction unit which corrects the distortion of the image due to the angle with respect to the image data.

- 5 18. The image retrieving device according to claim 1, which collects the sequence of image data with the lens angle having a known lens angle difference with respect to the reference direction, further comprising:

an image angle correction unit which corrects the
10 distortion of an image resulting from the difference in the lens angle.

19. The image retrieving device according to claim 1, which has all-around image data obtained by a fish-eye lens as
15 the sequence of image data, further comprising:

an image upright correction unit which extracts an image in a specified direction from the all-around image data and for correcting it into an upright image.

- 20 20. The image retrieving device according to claim 1, which has stereoscopic image data obtained by using two stereoscopic lenses spaced with a predetermined gap as the sequence of image data, further comprising:

a polarization processing unit which carries out a
25 polarizing process on each piece of the stereoscopic image

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21. The image retrieving device according to claim 16,
further comprising:

an image size correction unit which corrects a
10 difference in the image size caused by the distance with
respect to the image data.

15 a junction detection unit which detects a crossing
point from the map data and;

23. An image collecting device comprising:
an image recording unit which records a sequence of
25 picked-up image data together with the image pickup times;

a position acquiring unit which acquires attribute information containing at least an image pickup position and image pickup time;

a position-time recording unit which records the
5 attribute information acquired by the position acquiring unit; and

a recording control unit which controls the image recording unit and the position-time recording unit to carry out the recording operations with the respective recording
10 times being synchronous to each other.

24. An image collecting and retrieving system comprising:

at least one image collecting device which includes

an image recording unit which records a sequence of
15 picked-up image data together with the image pickup times;

an image reading unit which reads the sequence of image data;

a position acquiring unit which acquires attribute information containing at least an image pickup position
20 and image pickup time;

a position-time recording unit which records the attribute information acquired by the position acquiring unit;

a recording control unit which controls the image
25 recording unit and the position-time recording unit to carry

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out the recording operations with the respective recording times being synchronous to each other; and

a transmission processing unit which successively transmits the sequence of image data read by the image reading

5 unit and the attribute information, and

an image retrieving device connected to the at least one image collecting device, the image retrieving device includes

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10 a receiving processing unit which receives the sequence of image data and the attribute information transmitted from the at least one image collecting device;

an image data holding unit which holds the sequence of image data received by the receiving processing unit;

15 an attribute information holding unit which holds the attribute information received by the receiving processing unit;

20 a matching unit which matches the sequence of image data held in the image data holding unit with the attribute information read by the attribute information reading unit based upon the image pickup times;

an image database which holds the matching relationship that has been determined by the matching unit;

a map data holding unit which holds map data;

25 a map display processing unit which displays the map data on a map display unit based upon the map data;

an image retrieving unit which retrieves the image database;

a locus display processing unit which allows the image retrieving unit to retrieve for image data having image pickup positions within a map displayed by the map display unit, and displays the retrieved pickup positions on the map as a locus;

an image display unit which displays the sequence of image data;

a position specifying unit which specifies a position of the map displayed on the map display unit; and

an image processing unit which acquires image data corresponding to the image pickup position in the vicinity of the position specified by the position specifying unit from the image data holding unit, and reproduces and displays the resulting image data on the image display unit.

25. The image collecting and retrieving system according to claim 24, wherein the at least one image collecting device further comprises a transfer adjusting unit which thins the image data to be transmitted so as to adjust the amount of data to be transmitted.

26. The image collecting and retrieving system according to claim 24, wherein the image retrieving device further comprises a communication destination selection unit which switches the receipt of the sequence of image data and attribute information transmitted from the at least one image collecting device in a time-divided manner.

27. The image collecting and retrieving system according to claim 24, further comprising a collection instructing unit which gives instructions for collecting operations including the start and finish of the image collection to the image collecting device,

wherein the image collecting device further includes an image collection control unit which controls the image collecting device based upon the collection instruction by the collection instructing unit.